

**ENVIRONMENTAL PROTECTION AGENCY (EPA)
2021 TARGETED AIRSHED GRANT PROGRAM
EPA-OAR-OAQPS-21-03**

Project Title: **Zero-Emission Freight Line-Haul Locomotive Repower with Supporting Charging Infrastructure**

Applicant Information: South Coast Air Quality Management District, a regional agency with jurisdiction over air quality in California's South Coast Air Basin (SCAB).

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DUNS Number: 025986159

Budget Summary:

EPA Funding Request	Voluntary Cost Share	Other Leveraged Funds	Total Project Cost
\$4,174,000	2,533,000	2,200,000	\$8,907,000

Project Period: January 2022 to July 31, 2025

Project Description: Progress Rail(PR), a Caterpillar Company, will replace one BNSF Tier 1+ freight line-haul locomotive engine with an 8 megawatt-hour battery-powered propulsion system. Two 1.4MW chargers with a unique pantograph interface will be installed at Los Angeles and Barstow Stations to support the charging. The proposed Project will be the first-ever zero-emission line-haul locomotive repower in the SCAB which would eliminate the emissions from a Tier 1+ line-haul locomotive that operates 240 miles round-trip between Los Angeles and Barstow.

Project Location: The locomotive selected to be replaced currently operating between Los Angeles and Barstow. The proposed Project will operate at least 85% of the time in the Los Angeles-South Coast Air Basin (SCAB), which would benefit the disadvantaged communities within Los Angeles, Riverside, and San Bernardino counties that are recognized as the most polluted areas for ozone by the US Environmental Protection Agency (EPA).

PROJECT NARRATIVE

Workplan

The South Coast Air Quality Management District (South Coast AQMD) is submitting Zero-Emission Freight Line-Haul Locomotive Repower with Supporting Charging Infrastructure application in response to the EPA “2021 Targeted Airshed Grant Program” (EPA OAR-OAQPS-21-03) Request for Applications (RFA) pertaining to the South Coast Air Basin (SCAB). The South Coast AQMD is the regional air quality agency responsible for Orange and the urban portions of Los Angeles, San Bernardino, and Riverside Counties. This area of 10,743 square miles is home to over 17 million people – about half the population of the state of California. It is the second most populated urban area in the United States and encompasses over 130 cities. The South Coast AQMD has regulatory responsibility for more than 100,000 businesses operating stationary sources, of which about 30,000 have air quality permits. Despite decades of aggressive efforts to reduce air pollution from stationary sources, the SCAB continues to have some of the worst air quality in the US, based on the number of days the National Ambient Air Quality Standards (NAAQS) for ozone are exceeded. Currently, the SCAB and Coachella Valley portion of the Salton Sea Air Basin (SSAB) has areas in non-attainment for ozone and particulate matter (PM_{2.5}). The most effective way to reduce air pollution impacts on the health of the SCAB’s residents, including those in disproportionately impacted and environmental justice communities (EJCs) that are concentrated along our transportation corridors and goods movement facilities, is to reduce emissions from mobile sources, both on-road and off-road, the principal contributor to the SCAB’s air quality challenges. Consequently, the South Coast AQMD continues to work closely with the California Air Resources (CARB) and the US EPA, who have primary responsibility for these mobile sources.

Section 1. Project Summary and Approach

1-a. Detailed Project Summary and Emission Reduction Activities

Diesel locomotives generally utilize very large diesel combustion engines and have a long service life. The emissions of NO_x, PM, hydrocarbon, and greenhouse gases (GHG) are distributed from long-distance hauling and are highly concentrated in the railyards. Purchasing new locomotives with lower emissions is costly. The locomotives are designed to remain in service for more than 20 years. To achieve emission reductions and meet the SCAB’s attainment needs, emission reductions from the locomotive category require strong actions at the federal level to encourage the development and penetration of cleaner locomotive technologies. The proposed Project provides significant emission reductions to support the attainment of NAAQS by developing a zero-emission solution for locomotives which is consistent with the goals stated in EPA’s Fiscal Year 2018-22 Strategic Plan.

The proposed Project will convert a Tier 1+ diesel-electric freight line-haul locomotive owned by BNSF to an 8 megawatt-hours(MWh) LiFePO battery-powered propulsion system. The 4,300 horsepower (HP) zero-emission, battery-electric locomotive will be capable of operating anywhere in a freight consist including lead (point) or as distributed power unit (DPU) in the consist. The proposed Project is categorized under engine replacement and will achieve zero tailpipe emissions. Progress Rail (PR) will design, manufacture and perform the conversion for the proposed Project. The candidate locomotive to be converted will be an SD70MAC manufactured previously by EMD (now known as Progress Rail). BNSF owns and operates more than 500 SD70MAC line-haul locomotives nationwide, including in California. BNSF operates mostly GE Transportation (GE) model locomotives for the route between Los Angeles and Barstow, but the introduction of a dedicated PR battery-electric locomotive will displace the need for a conventional diesel locomotive for the Los Angeles and Barstow route, thereby reducing the emissions in the SCAB by retiring a high emitter. The upgraded locomotive will be operating at least 85% of the time in the SCAB.

PR will strip the locomotive’s diesel engine and supporting diesel equipment, including the fuel tank, exhaust system, cooling



system, and controls. The electric propulsion system will be designed and manufactured specifically for the PR SD70MAC locomotive.

The converted locomotive engine will be scrapped, meeting the scrappage requirement stated in the RFA Section I.C.2.a. The replaced engine will be cut with a three-inch by three-inch hole in the engine block. A scrappage statement and pictures will be provided with the project's final report. The converted locomotive will be operating between Los Angeles and Barstow for a minimum of 5 years.

The candidate locomotive is one of BNSF Tier 1+ locomotives manufactured prior to 2000 with at least three years of remaining life. The locomotive to be selected will have operated more than 1,000 hours/year during the past 2 years. Detailed locomotive and usage information are included in Attachment 2, EPA Diesel Emissions Quantifier (DEQ) Emission Results. The proposed Project is expected to achieve annual emission reductions of 8.54 tons of NO_x, 0.32 tons of PM_{2.5}, and 0.60 tons of HC, 1,632 tons of CO, and 1,125 tons of CO₂.

Battery electric locomotives have been operating in many countries worldwide for decades; however, the advent of lithium-ion batteries has been a complete game changer and has enabled long endurance sufficient for a successful rail application. PR deployed a battery-electric locomotive in Brazil last year, and the locomotive has been successfully operated for an extended period of time. PR is scheduled to deploy another battery-electric locomotive on the network of Port of Los Angeles in 2021.

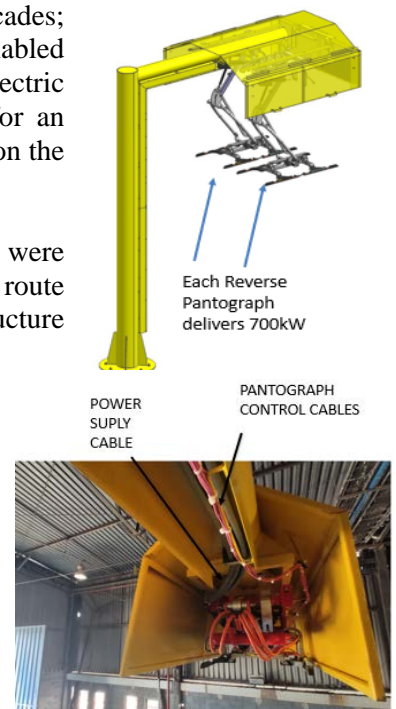
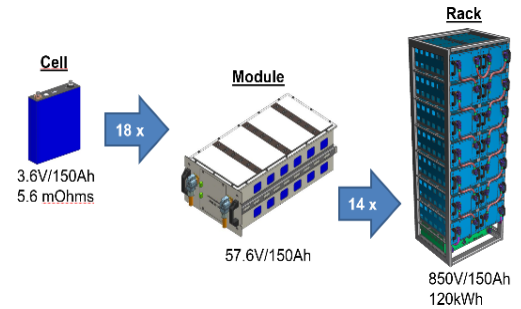
Two zero-emission options, including battery-electric and fuel-cell powered conversion, were assessed. The engine replacement with battery-electric option was selected based on the route length, terrain, cost, technology readiness, fleet experience, and supporting infrastructure availabilities between Los Angeles and Barstow.

A high-power fast charger will be installed at both Los Angeles and Barstow stations. The details of this system are still being finalized but the system will be able to connect to the locomotive to charge automatically. The Association of American Railroads (AAR) is developing a locomotive charging interface standard currently; BNSF and PR are actively participating in this effort. These chargers will use the most relevant version of the AAR standard possible to ensure future compatibility. The locomotive will also be equipped with a train energy optimization system to ensure the most efficient use of the locomotive within a consist.

1-b. Quantitative Analysis of Emissions Inventory

The South Coast Air Basin was identified by EPA as extreme non-attainment for ozone and ranks as one of the top five most polluted areas for the 8-hour ozone and PM_{2.5}. Based on the South Coast AQMD's 2016 Air Quality Management Plan (AQMP), the most significant air quality challenge in the Basin is to reduce NO_x emission sufficiently to meet the upcoming ozone standard deadlines. Based on the inventory and modeling results, 522 tons per day (tpd) of total Basin NO_x 2012 emissions are projected to drop to 255 tpd and 214 tpd in the 8-hour ozone attainment years 2023 and 2031, respectively, due to the continued implementation of already adopted regulatory actions. The analysis suggests that total Basin emissions of NO_x must be reduced to approximately 141 tpd in 2023 and 96 tpd in 2031 to attain the 8-hour ozone standard. This represents an additional 45% reduction in NO_x in 2023, and an additional 55% NO_x reduction beyond 2031 levels.

CARB is working on compiling the 2020 locomotive inventory and revising the state's locomotive regulations. The detailed emissions inventory is included in Attachment 1. The latest CARB locomotive inventory published for 2012, estimated that Union Pacific Railroad (UP) and BNSF interstate line-haul locomotives contribute to 85% of statewide locomotive NO_x emissions (see Table 1). UP and BNSF operate over 10,000 interstate line-haul locomotives annually within California. Based on the CARB's data showed in Figure 1, in 2020, locomotives contribute to 80 tpd of NO_x in California, and over



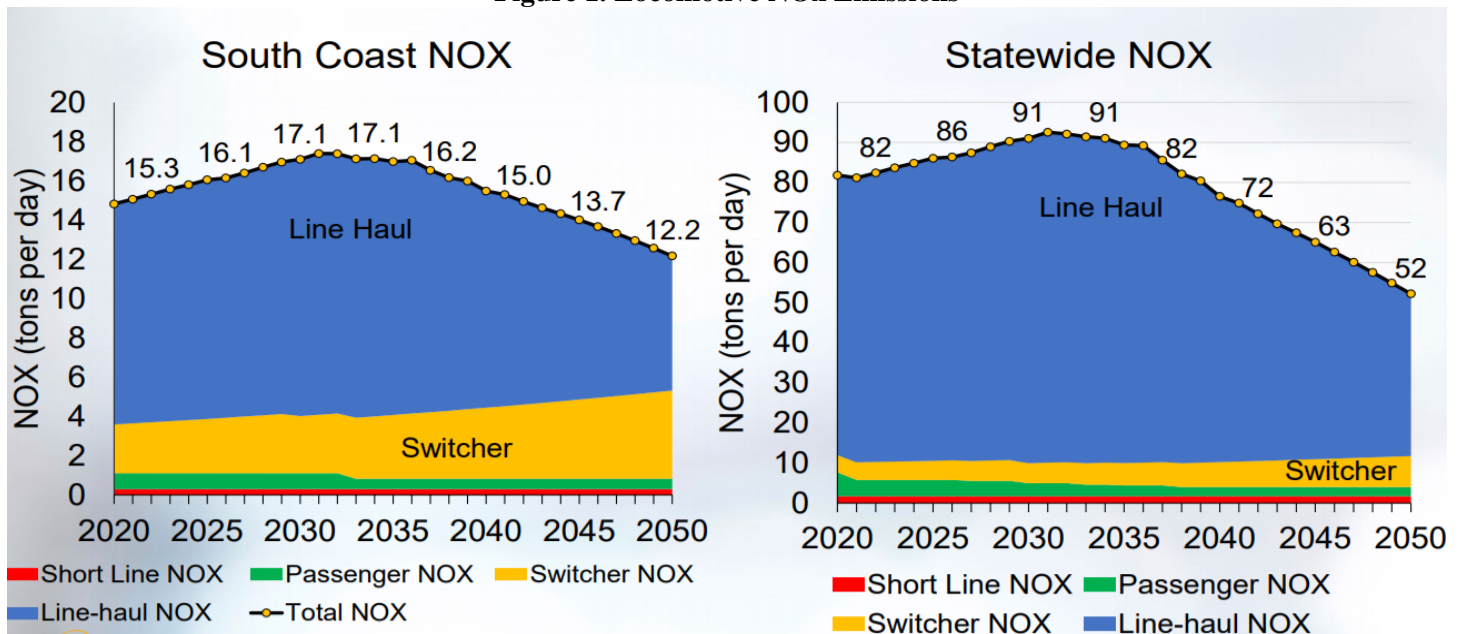
18% or 15tpd is in SCAB. The percentage of locomotive emissions in the Basin is likely to increase with fewer emissions from other mobile sources due to adopting new regulations and cleaner engine technologies implementation.

Table 1. California Locomotive and % of Statewide Locomotive NOx Emissions

Type of Service	Locomotive Category	Statewide Locomotive NOx Emissions (%)
Freight	Class I Interstate Line Haul Locomotive	85
	Class I Interstate Locomotives	8
	Class III Short line Interstate Locomotives	1
	Military and Industrial Intrastate Locomotives	<0.4
Passenger	Passenger Intrastate MHP Locomotives	6

Data source: CARB's 2016 Technology Assessment: Freight Locomotives

Figure 1. Locomotive NOx Emissions



Data Source: CARB 2020 Locomotive Emission Inventory

The estimated NOx, PM_{2.5}, HC, and CO₂ reductions for the proposed Project are shown in Table 2. The annual estimates of emission reductions are based on an average of 1,000 hours/year of operation and 100,000 gallons/year of diesel fuel usage. The project life for the proposed Project is 5 years, but it is expected that the upgraded locomotive will remain in service for at least 5 more years after the life of the proposed Project.

Table 2. Emission Reductions of Proposed Project

Emission Reduction (ton)	NOx	PM _{2.5}	HC	CO ₂
Daily	0.02	0.0009	0.002	3.08
Annual	8.54	0.32	0.60	1,125
5-Year (Project Life)	42.70	1.59	3.00	5,625

1-c. Activities Toward to Reduce Emissions and Reasons the Proposed Emission Reduction Solution was Chosen

Line-haul locomotives account 85% of locomotives' NOx emissions in California and consumed an estimated 240 million gallons of diesel fuel. Two zero-emission options, including battery-electric and fuel-cell powered conversion, were

assessed for the proposed Project. The engine replacement with battery-electric option was selected based on the route length, terrain, technology readiness, fleet experience, and supporting infrastructure availabilities between Los Angeles and Barstow. Battery-electric locomotives could eliminate the use of diesel fuel and harmful emissions. As battery energy density and costs improve, the proposed Project could accelerate technology development and adoption. The electrification of the line-haul locomotive is consistent with the demonstrator BNSF’s plan to electrify their other equipment, including switchers, heavy-duty trucks, and yard tractors, with energy storage installation. Additional emission reductions are expected with the deployment of additional zero-emission locomotives and other mobile equipment soon. The development of zero-emission technology provides locomotive operators options to cleaner than Tier 4 engines, which is the cleanest emission standard currently.

In addition, there are many benefits of operating heavy-duty electrical equipment. Although the initial cost of electric systems is higher than fuel systems, the electric system's cost is typically offset by fuel-saving and less maintenance and the abilities of vehicle data acquisition, performance tracking, and quieter operation. Also, there would be a reduction in GHG emissions.

1-d. Progress Towards Attainment and Maintaining the Applicable NAAQS

The EPA’s locomotive regulation applies to all diesel line-haul, passenger, and switch locomotives that operate extensively within the United States, including newly manufactured locomotives and remanufactured locomotives that manufactured after 1972. Further, locomotives originally manufactured before January 1, 1973, are not considered new when remanufactured unless upgraded.

One of the off-road mobile source emission control measures in South Coast AQMD’s 2016 AQMP is accelerating the introduction of zero- and near-zero emission technologies off-road equipment through a mobile source emission reduction credits generating program. The existing line-haul locomotive, as described in Attachment 2 was built prior to the year 2000 and powered by a 4300 hp diesel engine. Therefore the locomotive is covered under the EPA’s locomotive rule, “Control of Emissions of Air Pollution from Locomotives” (40 CFR part 1033). The existing locomotive complies with the Tier 0, 0+, or 1+ emission standard. If the existing type of engines needs to be replaced, they will either be original Tier or overhauled in kind. Consequently, the proposed Project will not be used to satisfy any applicable requirements under the rule but are in excess of above and beyond those applicable mandates. The significant emission reduction benefits are estimated in Table 2, based on the difference between Tier 1+ and zero-emission standards for the proposed locomotive. It is expected to achieve at least 8.54 ton NOx, 0.32 tons PM_{2.5}, 0.60 ton HC, 1.63 ton CO, and 1,125 ton CO₂ annually. The technology developed for this Project provided the potential to reduce more emissions from the diesel locomotives with a larger deployment of battery-electric line-haul locomotives throughout the Basin.

1-e. Roles and Responsibilities

The parties involved in this proposed Project including the South Coast AQMD, BNSF, and PR. The role and responsibilities are as listed:

Roles	Responsibilities
South Coast AQMD	<ul style="list-style-type: none"> • The Administrator of the proposed Project • Contract with BNSF • Oversee, monitor, and track project progress • Provide reports and updates to EPA • Submit disbursement request to EPA
Program Beneficiary- BNSF	<ul style="list-style-type: none"> • Finalizing the locomotive selection • Execute an agreement with Progress Rail • Provide PR the locomotive operation profiles • Confirm the locomotive conversion schedule • Provide locomotive routes information • Provide logistic information to assist the commissioning and testing • Submit quarterly and final reports to SCAQMD

Contractor- Progress Rail

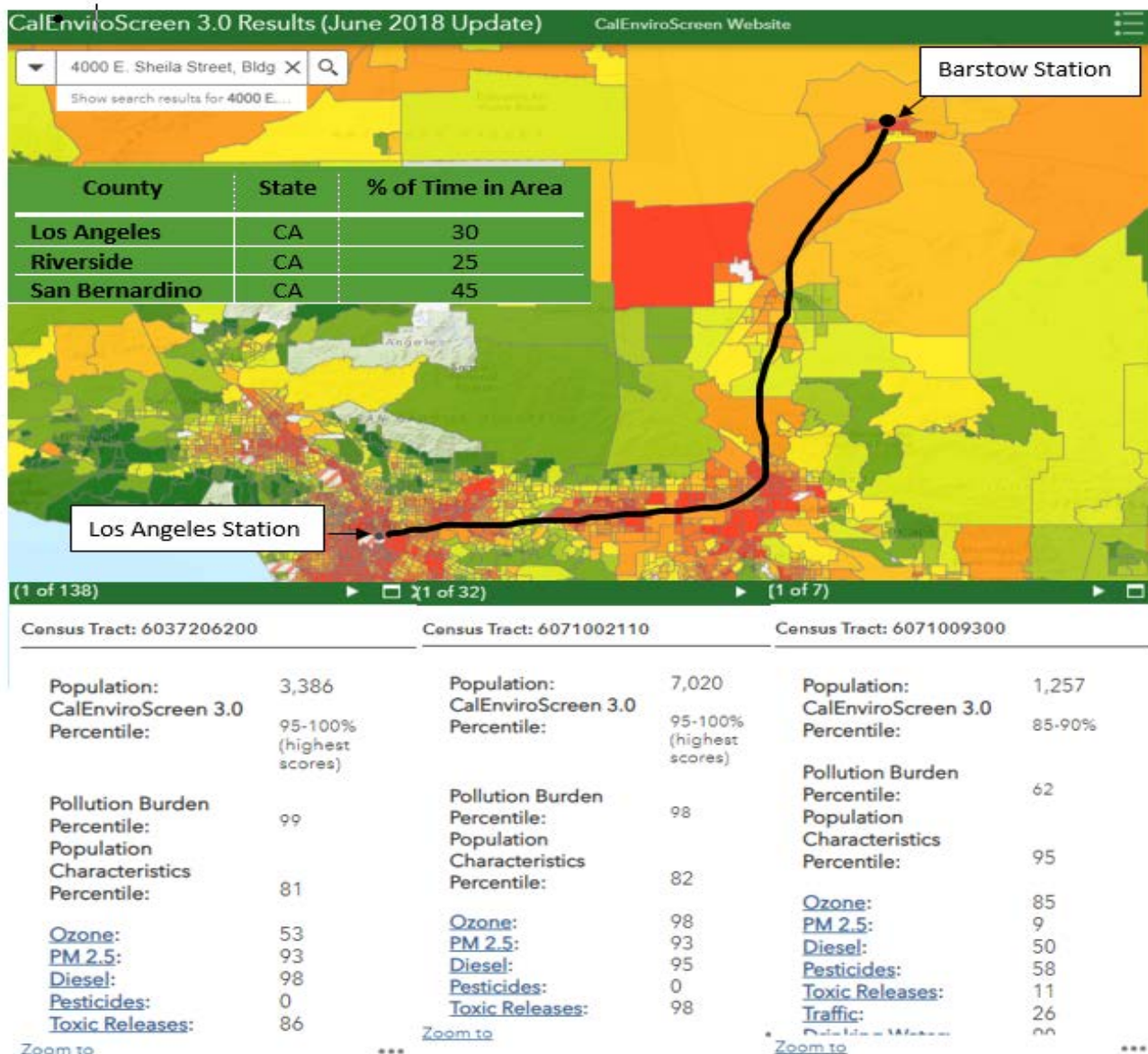
- Design and manufacture battery-electric propulsion system
- Remove the old diesel engine, components and prepare the locomotive chassis for the conversion
- Install the battery-electric propulsion system
- Conduct all the required testing, validations and obtain necessary approvals from the authorities.
- Provide BNSF operation and safety training
- Provide monthly progress updates to SCAQMD

Section 2. Environmental Justice

2-a. Environmental Justice Issues and Environmental Health Disparities

The proposed locomotive will operate between Los Angeles and Barstow stations. The locomotive travels across Los Angeles, Riverside, and San Bernardino counties and spent at least 85% of its time in the SCAB, as shown in Figure 2, CalEnviroScreen 3.0 results. These counties were designated as the most polluted area for ozone or PM2.5 emissions. The proposed Project's emission reductions and health benefits will be realized throughout the Basin, particularly densely populated areas within close proximity of rail tracks and railyards.

Figure 2. CalEnviroScreen Results



A high-power electric charger will be installed at both LA and Barstow stations. Based on the EPA's Environmental Justice Screening and Mapping Tool (EJSCREEN) data (Attachment 7), BNSF Los Angeles Intermodal Facility (LA Station), where the locomotive stops, idles, and charges are located in a community with over 95% of people of color and 87% of low income. Also, the location is over 90 percentiles of PM_{2.5}, Ozone, diesel PM, and air toxics cancer risk in the USA and over 80% in the region. Both stations are located in a disadvantaged community with demographic index of 95%. Although the Barstow station is not within the SCAB, it is located in San Bernardino County, with over 97% people of color and 89% low-income.

The residents of these areas are disproportionately impacted by heavy diesel traffic along the goods movement corridors, rail tracks, and diesel activities in nearby railyards. Many communities, including a few South Coast AQMD's AB617 communities within each county, have serious environmental justice concerns. The concerns were documented in many letters and recorded meetings as described in section 2-b. The South Coast AQMD has limited authority over rail transportation but working closely with CARB and EPA to create a new emission tier for the locomotive engines. The communities suggested that the South Coast AQMD develop cleaner locomotive technologies to reduce residents' exposure to environmental hazards. The South Coast AQMD is committed to making decisions a community-driven process, including conducting extensive outreach in multiple languages and locations.

Based on the EPA diesel emissions quantifier (DEQ), the proposed Project will eliminate approximately 42.7 tons NO_x, 0.96 tons PM_{2.5}, 1.80 tons HC, and 4.90 tons CO and 3,375 tons of CO₂ emissions over the remaining life of the existing locomotive, significantly increasing public health benefits to residents in proximity of rail tracks and railyards. In addition to the quantifiable emission benefits, the proposed Project provides significant unquantifiable benefits in terms of diesel odors, noise pollution, visibility, global warming, and health cost (hospitalization, premature deaths, truancy, missed workdays, etc.).

2-b. Communities Engagement

The selected freight line-haul locomotive operates at goods movement facilities, rail yards, and distribution centers, as indicated in Figure 3.

Figure 3. Proposed Locomotive Operating Route



The South Coast AQMD has been conducting extensive community-based efforts that focus on improving air quality and public health in environmental justice (EJ) communities and working with community members to develop a Community Emission Reduction Plan to fulfill AB617 community Air Initiatives requirements. Since Assembly Bill (AB) 617 was signed into California law in July 2017, the South Coast AQMD has hosted a series of meetings seeking input on prioritizing communities in our region for future air monitoring and emission reduction programs. The South Coast AQMD hosts meetings at the five AB 617 communities in SCAB at least once a month since 2018. The South Coast AQMD also hosted a joint meeting with CARB at San Bernardino in December 2019 to discuss concepts to reduce emissions from locomotives and railyards with the communities. The communities have been expressed concerns at the meetings about the locomotives diesel emissions and requested the prioritization of zero-emission technology development and deployment. Railyard and locomotive emissions are major air pollution sources and concerns in EJ communities. Diesel locomotives emit toxic air contaminants that cause cancer, congenital disabilities, and other serious harm. Controlling emissions from locomotives

and encourage fleet turnover would result in immediate emission reductions. Communities' concerns are expressed in writing in the Draft Staff Report (Proposed Rule 2305 – Warehouse Indirect Source Rule-Warehouse Actions and Investments to Reduce Emission Program and Proposed Rule 316 – Fees for Rule 2305, https://www.aqmd.gov/docs/default-source/planning/fbmsm-docs/pr-2305_sr_2nd-draft_4-7-21_clean.pdf?sfvrsn=8) and the public comments during the AB 617 community meetings (<https://www.facebook.com/630750133606830/videos/3655658074648225>).

The South Coast AQMD, CARB, and US EPA have air quality regulations to reduce air pollution from these sources. In addition, South Coast AQMD has an ongoing effort working with AB617 communities, CARB, and EPA to evaluate potential strategies to reduce emissions from railyards. The proposed Project would significantly reduce emissions and address resident concerns in many communities.

Section 3. Environmental Results – Outcomes, Outputs, and Performance Measures

3-a. Expected Project Outputs and Outcomes

The emission reductions were calculated using EPA's DEQ. The emissions were quantified based on upgrading a Tier 1 line-haul with the zero-emission power source (see Attachment 2 and 3). The fuel usage and hours of operation are included in Attachment 2. The lifetime emission reduction was based on 5 years of project life. The locomotive is expected to continue operating for at least 5 more years after the life of the projects. The line-haul locomotive upgrade is very cost-effective at \$92,905/ton of NOx reduced. Based on Carl Moyer Program's cost-effectiveness (CE) calculation, it would be increased to \$53,106/ton of NOx and PM reduced (PM reductions are weighted by a factor of 20 due to diesel PM toxicity). The project cost includes charging infrastructures which are estimated at 30% of the total project cost. The cost-effectiveness could be increased to \$18,587/ton of NOx and PM reduced if the project's life increases to 10 years with the reduced cost of the infrastructure for a larger deployment.

Table 3. Outputs and Outcomes

<i>Anticipated Outputs and Outcomes</i>		
<i>Activities</i>	<i>Outputs</i>	<i>Outcomes</i>
Upgrade One MY2000 Tier 1+ Line-Haul Locomotive Engine	Replace one Tier 1+ Line-Haul Locomotive Engine with Zero-Emission System	<i>Annual Emissions Reduction = 8.54 ton NOx, 0.32 tons PM_{2.5}, 0.60 ton HC, 1.63 ton CO, and 1,125 ton CO₂</i>
		<i>5-year Lifetime Emissions Reduction = 42.7 ton NOx, 1.6 tons PM_{2.5}, 3 ton HC, 8.16 ton CO, and 5,625 ton CO₂</i>
		<i>Annual Diesel Fuel Reduced = 100,000 gallons Lifetime annual Diesel Fuel reduced (Over 5 Years) = 500,000 gallons</i>
		<i>Project Cost Effectiveness = \$92,905/ton NOx Project Cost Effectiveness = \$53,106/ton NOx & PM*</i>
Upgrade 100 MY2000 Tier 1+ Line-Haul Locomotive Engines	Replace 100 Tier 1+ Line-Haul Locomotive Engines with Zero-Emission Systems	<i>Annual Emissions Reduction = 854 ton NOx, 32 tons PM_{2.5}, 60 ton HC, 163 ton CO, and 112,500 ton CO₂</i>
		<i>10-year Life Emissions Reduction = 8,540 ton NOx, 320 tons PM_{2.5}, 600 ton HC, 1,630 ton CO, and 1,125,000 ton CO₂</i>

* PM reductions used for cost-effectiveness calculation are weighted by a factor of 20 due to diesel PM toxicity

3-b.Expected Emission Reductions and Strategy to Achieve On-Going, Significant Emissions Reductions:

The strategy for achieving the anticipated emission reductions and health benefits begins by selecting one of a lower Tier line-haul diesel locomotive from the BNSF fleet. The line-haul diesel locomotive is selected because there is a need to achieve significant emissions reductions from rail diesel activities. And the line-haul locomotives account for 85% of total locomotive emissions in SCAB. Second, the technology is selected because there are commercially available zero-emission

technologies for the engine replacement project and can be implemented quickly. Third, the South Coast AQMD has extensive experience working with locomotive operators and technology providers. The South Coast AQMD worked with Metrolink and PR on one of the nation's largest Tier 4 locomotive deployments that deployed 40 passenger locomotives. The first Metrolink locomotive entered into service in late 2017. All 40 locomotives were delivered to Metrolink, and 39 were in service as of today. The 40th locomotive will be in service within a few weeks. One of Metrolink's Tier 4 locomotives was awarded by EPA Year 16 DERA Grant. The EPA-funded locomotive has been in service since 2020.

BNSF was selected as a demonstration partner who has deployed many Tier 4 locomotives during the past few years and actively participates in the zero-emission and hybrid technology demonstration projects to promote and make continuous efforts to reduce diesel locomotives' emissions. BNSF is the rail industry leader in implementing zero-emissions equipment and has implemented 20 zero-emission hostlers across California, two hybrid rubber tire gantry cranes, a battery-electric side loader, and a battery-electric locomotive used in hybrid consist service. BNSF's experience in implementing low and zero emissions projects across the state of California make them uniquely qualified to implement this project successfully.

After the conversion, the locomotive will be placed into service operating between Los Angeles and Barstow stations. Based on lessons learned from early deployments, the implementation of this project is expected to go smoothly and efficiently, with the realization of emissions reduction benefits as soon as the locomotive is converted. Finally, the South Coast AQMD has assembled a team to implement the proposed Project including, monitoring and reporting activities (see Sections 3-c and 3-d). In addition, the destruction of the existing locomotive engine will be confirmed by the South Coast AQMD inspector. The inspector will conduct a destruction inspection confirming that the locomotive engine is destroyed and verify that a 3-inch by 3-inch hole was cut into the engine block. The inspection reports, including locomotive information and photos, will be filed in the project file. This will ensure that the emissions and health benefits are real and permanent.

Both BNSF and Progress Rail have plans for larger zero-emission locomotives and equipment deployment in the near term. BNSF has been actively exploring options to reduce their fleet locomotives emissions by replacing the locomotives with cleaner engines and participating in research and demonstration projects to develop cleaner engine technologies. BNSF's intent is stated in their 2018/2019 Corporate Sustainability Report, Technology Section (<https://www.bnsf.com/bnsf-resources/pdf/in-the-community/environment/sustainability-report-2018-2019.pdf>). Also, BNSF operates more than 500 SD70MAC line-haul locomotives that are the same model as the proposed locomotive. Therefore, the proposed Project provides a potential pathway to upgrade many locomotives to zero-emission. Progress Rail is committed to deploying hundreds of zero-emission locomotives to support the market demand. As a result, a more significant long-term emission reduction from the proposed Project is expected. Also, the South Coast AQMD has extensive experience implementing incentive programs. Therefore, the proposed Project's technology could be implemented through various incentive programs administered by the South Coast AQMD, such as Carl Moyer Program.

3-c. Performance Measures and Plan

Once awarded, the South Coast AQMD will prepare the board package and obtain our Governing Board's approval to execute a grant agreement with EPA. The agreement will specify the project scope, timeline, and milestones. The detailed timeline and milestones are listed in Table 4 of this proposal. Once the locomotive selection is finalized, the South Coast AQMD will execute a contract with BNSF. PR will design and manufacture the battery-electric system. PR will also perform the removal of the old engine, install, and commission the zero-emission locomotive. The contract will detail the milestone dates, deliverables, and payment schedule. In addition, BNSF will execute an agreement with the PR to ensure the completion of the conversion, obtain long-term technical support, equipment warranty, and completion of the project testing. During the project implementation, monthly updates from BNSF and PR will be required to track the project progress, emission reductions and resolve any issues that occur. The monthly updates should include electric system design and manufacture status, locomotive performance, usage data, area of operation, locomotive operational profiles, energy consumption, warranties, and durability. PR will also obtain necessary Federal Railroad Administration approvals and any other required approvals for the conversion.

The plan to track and measure progress toward achieving the expected project outputs and outcomes will be included in the contract under the milestones and deliverables. The quarterly reports after the commissioning will be submitted to EPA. After the project completion, a final report will also be submitted to EPA with the required scrappage statement and other supporting documents. Emission reductions will be tracked and calculated based on the DEQ included in the final report to support the outputs and outcomes stated in this proposal.

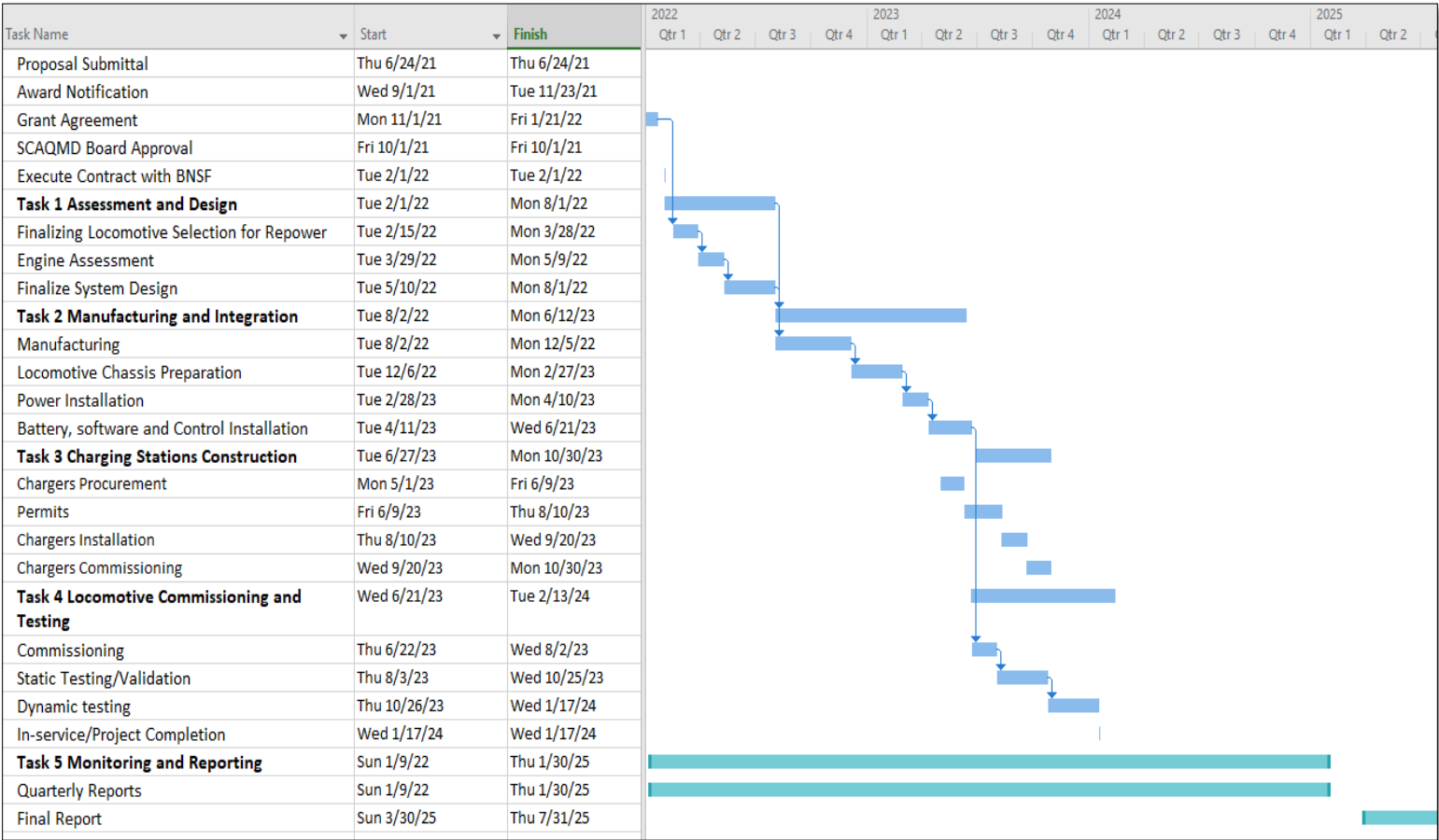
The proposed Project will be implemented by South Coast AQMD Technology Advancement Office (TAO) and will employ the following approach in anticipating, responding to, and mitigating issues that may arise: 1) set reasonable deadlines; 2) set detailed contingency plans for predictable delays; 3) regularly review the project schedule and deliverables; 4) establish and maintain lines of communication with all team members; and 5) use delays as opportunities to re-think decisions that led to problems, take advantage of changing circumstances, and improve project deliverables. If an unforeseen delay occurs, South Coast AQMD will work with the project team to identify multiple solutions, including updating deadlines, modifying deliverables, and retaining additional resources as needed. For tracking and measuring the project progress, contractors will be required to submit all information required by South Coast AQMD and EPA.

3-d. Timeline and Milestones

A detailed project plan is divided into five major tasks: initial administrative duties, assessment and design, manufacturing and integration, charging station construction, locomotive commissioning and testing, and monitoring and reporting. The timeline for completing the project and technical milestones associated with the five tasks are outlined in Table 4. The selected locomotive engine will be replaced and placed into service by the 1st quarter of 2024. This schedule is reasonable to complete the proposed Project and achieve project goals and objectives. In addition, the South Coast AQMD will monitor and collect operational and performance data from BNSF for the project duration.

Quarterly progress reports and a detailed final report will be provided. Quarterly reports will summarize technical progress and progress made on achieving the outputs and outcomes, emission reductions, planned activities, usage records for the current quarter, and a summary of cumulative expenditures. In addition, the final report will include a summary of the project and activity, usage, progress made on achieving the output, and outcomes detailed in the Project Workplan and costs. The final report will also include all signed eligibility statements, scrappage statements, discussion of problems, success, and lessons learned from the proposed Project.

Table 4. Proposed Project Timeline



Section 4. Programmatic Capability and Past Performance:

4-a. Past Performance

The South Coast AQMD has been the prime applicant for dozens of successful, federally co-funded emission reduction projects, including many TAG, DERA Grants, including projects under the locomotive categories. The South Coast AQMD has the expertise and project management capabilities to ensure that project deliverables are completed successfully and that reports are complete on time. A list of recent federally funded projects is shown below in Table 5.

Table 5: EPA-Funded Assistance Agreements

EPA Agreement (Project Title and Agreement Number)	Description	CFDA Number	Status of Deliverables	Status of Reporting
Battery Electric Yard Tractor Replacement at Ports of LA and Long Beach (99T48501)	The agreement (\$2.48 million) is to replace 16 LPG or diesel-fueled yard tractors with battery-electric yard tractors at the Ports of LA and Long Beach	66.202	Ongoing	Progress reports submitted on a quarterly basis
Shuttle Bus Replacement (EM-99T71501)	The agreement (\$3.2 million) is to replace conventional diesel and gasoline-powered shuttle buses with zero-emission shuttle buses in Southern California airports	66.202	Ongoing	Progress reports submitted on a quarterly basis
Daimler Develop Heavy-Duty Trucks with EV Infrastructure (A00909418)	The agreement (\$500,000) is to develop 20 heavy-duty battery-electric trucks with EV infrastructure and energy storage to demonstrate in real-world commercial fleet operations in DACs	66.001	Ongoing	Progress reports submitted on a quarterly basis
Ocean-Going Vessel Low-Pressure Exhaust Gas Recirculation Retrofit (LP-EGR), Polar Bear Pilot Vessel Conversion, and Deployment of New Flyer Zero-Emission Fuel Cell Buses (98T17401)	The agreement (\$17.3M) is to retrofit one Ocean-Going Vessel with LPEGR and convert the 2 nd vessel to a multifuel system, and deploy 5 fuel-cell transit buses	66.956	Ongoing	Progress reports submitted on a quarterly basis
Deployment of Electric Freight Trucks & Charging Infrastructure (98T14801)	The agreement (\$20M) is for a large-scale deployment of class 8 battery-electric freight trucks and charging infrastructure in the South Coast Air Basin and surrounding areas	66.956	Ongoing	Progress reports submitted on a quarterly basis
Diesel Emission Reduction Projects EM-00T34701-0	The agreement (\$5 million) is to (1) install a shore power infrastructure, (2) replace 25 HDDTs with 2010 compliant HDDTs, (3) replace and demonstrate up to 28 UPS diesel delivery trucks with zero-emission vehicles, and (4) replace 19 older diesel school buses with 2014 or newer natural gas school buses certified to meet 0.2 g/bhp-hr NOx and 0.01 g/bhp-hr diesel PM.	66.202	Completed	The final Technical report was submitted to EPA in 2017
On-Road Heavy-Duty Vehicle and School Bus Replacement Project DE-99T07001	The agreement (\$502,240) replaces eight Type D diesel school buses with low emission natural gas buses and repowers or replaces five Type C diesel school buses with electric school buses.	66.039	Completed	The final Technical report was submitted to EPA
Diesel Emission Reduction Projects DE-99T45901-0	The agreement (\$523,809) is to replace one Tier 0+ passenger locomotive with a new Tier 4 locomotive.	66.039	Equipment in Service	Progress reports submitted on a quarterly basis, pending final invoice and report

Electric Lawn& Garden Equipment Incentive and Exchange Program within Environmental Justice Areas 99T48301	The agreement (\$2.5M) is to accelerate the replacement of older commercial lawn and garden equipment with the latest zero-emission battery-electric commercial grade equipment.	66.202	Ongoing	Progress reports submitted on a quarterly basis
FY19 Heavy Duty Truck Replacement Project 99T89501	This agreement (\$2.3M) is to provide assistance to the South Coast Air Quality Management District (SCAQMD) in its efforts to replace 2013 or newer Class 8 diesel trucks with 2019 or newer trucks powered by compressed natural gas engines certified to meet the most stringent optional low nitrogen oxide emission standard of 0.02 g/bhp-hr.	66.039	Ongoing	Progress reports submitted on a quarterly basis
Volvo Battery Electric Excavator/Wheel Loader Development and Demonstration Project TA-99T92501	The agreement (\$2,100,00) is to develop and demonstrate two prototypes of battery-electric off-road construction equipment and mobile charging strategy.	66.956	Ongoing	Progress reports submitted on a quarterly basis

South Coast AQMD has a long history of successfully collaborating with Basin stakeholders to reduce emissions from a variety of mobile sources and stationary sources. South Coast AQMD is successfully implementing several air quality incentive programs including the VW Settlement, Proposition 1B, the Carl Moyer Program, and the Lower Emitting School Bus Program. Through the Carl Moyer Program, South Coast AQMD has generated 7,954 tons per year of NOx, 294 tons per year of ROG, and 232 tons per year of PM in the South Coast Air Basin, through the allocation of \$390 million in State funding. For the Proposition 1B, which entail more than \$458 million in State funding, South Coast AQMD spearheaded the deployment of over 6,595 zero and near-zero emission trucks, 25 ships at berth, three pieces of cargo handling equipment, and 20 locomotives, resulting in 42,798 tons of NOx and 1,154.5 tons of PM2.5 in the South Coast Air Basin for Years 1-5. In addition, under the Clean Fuels Program established in 1988, the South Coast AQMD successfully leveraged \$321 million in Clean Fuels funding for \$1.5 billion in projects, and managed numerous projects to develop, demonstrate and deploy various near-zero and zero emission technologies, as well as research, development, demonstration, and deployment of alternative fuel and clean fuels technologies. Over the past 32 years, South Coast AQMD has collaborated in partnership with other governmental organizations, private industry, academia, and research institutes and interested parties. Furthermore, South Coast AQMD has and is currently working on several EPA-funded projects, ranging from air monitoring programs to deployments of zero and near-zero emission vehicles. In 2019 alone, South Coast AQMD's Clean Fuels Program executed 76 new and continuing contracts, projects, and studies in collaboration with a wide cross-section of industry partners. In early 2019, South Coast AQMD received a \$45 million grant from CARB for the Volvo LIGHTS project in partnership with Volvo to deploy 23 pilot and production Class 8 battery electric trucks. The first five battery electric trucks were delivered to DHE and NFI in January 2020. Other recent examples of South Coast AQMD's successful leadership includes the \$40.1 million Zero Emission Drayage Truck Demonstration Program. South Coast AQMD has continuously partnered with Tier 1 suppliers and industry collaboratives, universities, and utilities to pull in the necessary technical and financial resources necessary to advance product development, demonstration, and commercialization of vehicle technologies. South Coast AQMD has successfully partnered with both State and federal agencies as well as regional collaboratives to develop, demonstrate and deploy near-zero and zero emission technologies including two DOE-funded zero emission drayage truck projects to demonstrate various types of electric and hybrid electric drive technologies, an overhead catenary system using wayside power to support cargo transport operations, and a plug-in hybrid truck with a geo-fencing feature to operate in zero emission mode in DACs disproportionately impacted by diesel exhaust.

South Coast AQMD's successful implementation of these past and on-going projects demonstrates that it is preeminently qualified to lead this deployment project. Its dedicated, experienced staff will lead and provide assistance in the following South Coast AQMD efforts: defining the project scope, statements of work, timeline and payment schedule for contractors; directing and assisting administrative and legal staff on negotiating terms and conditions with contractors; executing contracts; performing project management oversight; and authorizing payment upon verification and approval of deliverables. At the request of EPA, staff can provide documentation and additional information of South Coast AQMD resources and abilities to execute this project.

4-b. Reporting Requirements

South Coast AQMD's experience in managing the state and federal grants to agencies such as US EPA, DOE, CARB, and CEC has successfully administered large grant-funded projects. In addition, the organization's subject matter expertise and project management capabilities ensure that reporting is conducted on a complete and timely basis. As indicated in Table 5, the South Coast AQMD is in good standing on all past and ongoing projects and has submitted required reports for the awarded projects.

4-c. Organizational Experience & Staff and Resources

The South Coast AQMD has extensive experience in grant management, including managing EPA grants, preparing and managing projects with commercial fleets, technology developers, and monitoring work progress. This Project will be implemented by a Planning & Rules Manager, Financial Analyst, Program Supervisor, Contract Assistant, and Deputy District Counsel. Overseeing the South Coast AQMD team are Dr. Matt Miyasato and Aaron Katzenstein, Deputy and Assistant Deputy Executive Officers, respectively, for Science & Technology Advancement of the Technology Advancement Office. Dr. Miyasato and Dr. Katzenstein's principal charges are to identify, evaluate and stimulate the development and commercialization of clean air technologies, develop and coordinate mobile source regulations, and conduct ambient monitoring, source testing, and laboratory analysis. Dr. Miyasato received his undergraduate degree in Mechanical Engineering, and his master's and Ph.D. in Engineering, specializing in combustion technologies and air pollution control – all from the University of California, Irvine. Dr. Katzenstein received his doctorate in Atmospheric Chemistry, with twenty years of experience in multiple MATES studies, AQMP's, policy development, research projects, air quality studies, and technology/infrastructure projects. Joseph Impullitti is the Technology Demonstration manager whose duties will include overseeing the Project under the Program Supervisor. He has over 24 years of electric, hybrid, and fuel cell-powered medium- and heavy-duty vehicles/equipment design and development experience as well as supporting infrastructures. He also over 10 years of experience managing demonstration projects funded by the grant programs. Mei Wang is the Program Supervisor who will manage the proposed Project. She has over 20 years of experience in air pollution control technologies, emission source testing, advanced engine technologies, incentive programs. She has managed several demonstration projects from ocean-going vessel retrofits, commercial harbor craft, zero-emission vehicle-to-grid school buses, electric yard tractors, and infrastructure projects. She also has more than a decade of incentive implementation experience for Carl Moyer, Proposition 1B, and Enhanced Fleet Modernization programs that replaced thousands of light, heavy-duty vehicles, locomotives, and off-road equipment. She has a BS degree in Textile/Fiber and Composite Material Engineering and an MS degree in Environmental Science. The Air Quality Specialist will work under the supervision of the Program Supervisor to monitor and manage the day-to-day activities of the proposed Project. The specialist will have, at a minimum, a BS degree in engineering or air quality-related discipline and experience in managing air quality projects. The inspector will work under the supervision of the Program Supervisor to conduct the inspections. The duties of the Financial Analyst will include providing financial, administrative support for the proposed Project. The Deputy District Counsel will provide legal guidance to the staff throughout the planning and implementation phase of the proposed Project. The staff resumes are included in Attachment 6.

BNSF Experience & Staff and Resources

BNSF Railway Company is a wholly-owned subsidiary of Berkshire Hathaway Inc., headquartered in Fort Worth, Texas. It is one of North America's leading freight transportation companies. BNSF operates approximately 32,500 route miles of track in 28 states and also operates in three Canadian provinces. The network covers the western two-thirds of the United States, stretching from major Pacific Northwest and Southern California ports to the Midwest, Southeast, and Southwest and from the Gulf of Mexico to Canada.

BNSF is one of the top transporters of consumer goods, grain and agricultural products, low-sulfur coal, and industrial goods such as petroleum, chemicals, housing materials, food and beverages. BNSF's shipments help feed, clothe, supply, and power American homes and businesses every day. BNSF and its employees have developed one of the most technologically advanced and efficient railroads in the industry. BNSF works continuously to improve the value of the safety, service, energy, and environmental benefits we provide to our customers and the communities we serve. You can learn more about BNSF at www.BNSF.com.

Michael Cleveland is the lead for BNSF's battery electrification and energy storage initiative. Michael has over 10 years of experience with BNSF working in the locomotive department as a technology subject matter expert and project leader.

He has successfully implemented projects ranging from EPA engine certifications to battery-electric locomotive equipment. He has an MS in mechanical engineering from Texas A&M University and a BA in Physics from Austin College in Sherman, TX.

Progress Rail Experience & Staff and Resources

Progress Rail Services Corporation, Caterpillar Inc.'s Rail Division, is a customer focused company that has grown into one of the largest diversified suppliers of rail and transit products and services in North America. Progress Rail has become an industry leader by delivering quality materials, providing experienced and reliable services, and offering unprecedented convenience through their network of highly integrated, strategically located facilities. With more than 150 operations in North America, Latin America, Europe, Asia Pacific, and the Middle East, Progress Rail has become a one-stop shop for rail and transit customers in every corner of the world. Additionally, Progress Rail Services, through its subsidiary Progress Rail Locomotive (formerly known as Electro-Motive Diesel, Inc. and Electro-Motive Division of General Motors), is the largest and oldest original equipment manufacturer of diesel-electric locomotives in the world. Progress Rail Locomotive serves customers in more than 70 countries with an installed equipment base of over 33,000 locomotives.

The following list of Progress Rail employee will play an integral role in delivering, servicing, and supporting this project:

Name	Title	Years of Experience
Gary Eelman	SVP Strategic Initiatives	49
Ahmed Moustehy	VP North American Sales	20
Sidarta Beltramin	Director of Engineering	20
Derek Bowie	VP Customer Performance	20
Art Erbacher	VP Locomotive Services	20
Colin Kerelchuck	VP Aftermarket	20
Richard Chudoba	Engineering Senior Manager	30
Ryan Perkins	General Manager	10

Section 5. Budget

5-a. Detailed Budget Narrative

EPA's funding of 95% or \$3,967,000 is directed towards the locomotive repower and infrastructure for the demonstration partners. In addition, the South Coast AQMD, BNSF, and Progress Rail will provide \$2,533,000 in voluntary cost-share as outlined in their commitment letters (Attachment 4&5). BNSF and Progress Rail are also providing \$2.2M of other leveraged funds to support the project. The budget details are shown in Table 6.

Table 6. Budget Detail

Line Item and Itemized Cost	EPA Funding	Voluntary Cost Share	Other Leveraged Funds
Personnel -SCAQMD (Subrecipient)			
(1) Program Supervisor @ \$61.52/hr x 6hr/wk x 182 weeks	\$67,179.84		
(1) Contract Assistant @ \$26.87/hr x 2hr/wk x 25.3 weeks	\$1,359.62		
Personnel Total	\$68,539.46		
Fringe Benefits – 64.03% of Salaries. Includes Retirement, Health Benefits, FICA & SUI	\$43,885.82		
Travel (in-state:1,000 miles @ \$0.56/mile, out-of-state: 2 trips for 2 staff)	\$2,999.83		
Indirect Charges - 81.45% of Combined Salary and Benefit	\$91,574.89		
Administrative Fund Total	\$207,000.00		
Other			
Equipment-Program Beneficiary Recommended(BNSF)			
Battery module, power electronics, hardware, and etc.	\$3,119,033	\$1,000,000	
Chargers	\$100,000	\$1,000,000	
Integration and Installation	\$747,967	\$533,000	
TOTAL	\$4,174,000	\$2,533,000	\$2,200,000

TOTAL PROJECT COST	\$8,907,000
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Voluntary Cost Share/Other Leveraged Funds by Entity			
BNSF Cost-Share		\$1,000,000	\$1,000,000
SCAQMD Cost-Share		\$1,000,000	
Progress Rail Cost-Share		\$533,000	\$1,200,000
Total		\$2,533,000	\$2,200,000

5-b. Expenditure of Awarded Grant Funds

The South Coast AQMD staff has extensive experience in managing advanced technology development and implementation projects. Our highly experienced staff has the resources and expertise necessary to manage and implement the proposed Project, including drafting contracts with appropriate terms and conditions, detailed task descriptions, deliverables, and payment schedules tied to milestones to ensure all required tasks have been satisfied before funds are disbursed. In addition, South Coast AQMD will closely monitor the progress of the project, emission reductions and obtain monthly, quarterly progress reports from their contractors. Invoices payment is processed within 30 days of the receipt of completed invoices and supporting documentation to ensure the project is not negatively affected by delayed reimbursements.

5-c. Reasonableness of Costs

The total project cost is estimated to be \$8,907,000, of which the South Coast AQMD is requesting \$4,174,000 from EPA, including the administrative cost of \$207,000 necessary for the South Coast AQMD to implement the project. Over 95% of the fund requested will be used to supplement the costs for the equipment and installation. The South Coast AQMD, Progress Rail, and BNSF contribute a combined total of \$2,533,000 of voluntary cost-share, as indicated in Table 6. In addition, Progress Rail and BNSF are providing other leveraged funds up to \$2,200,000 to support the project. Letters of commitments are provided in Attachment 4 and 5.

Section 6. Attachments

Attachment 1- Emissions Inventory

Attachment 2- DEQ- Emission Results

Attachment 3- DEQ-Health Benefits

Attachment 4- Cost Share Commitment Letter- BNSF

Attachment 5- Cost Share Commitment Letter - Progress Rail

Attachment 6 -Resumes

Attachment 7-EJSCREEN Reports